IMPACT OF A DRUG ABUSE RESISTANCE EDUCATION (D.A.R.E) PROGRAM IN PREVENTING THE INITIATION OF CIGARETTE SMOKING IN FIFTH- AND SIXTH-GRADE STUDENTS

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An alarmingly high number of children become addicted to tobacco use. To teach children the skills to resist the influences surrounding the initiation of tobacco and other drug use, a Drug Abuse Resistance Education (D.A.R.E.) program is being implemented in three fourths of the schools in the United States. The purpose of this study is to examine the impact of this program in preventing smoking. A survey was conducted among 236 fifth and sixth graders in Nashville, Tennessee. Of the students included in the survey, 88% graduated from D.A.R.E. Approximately 11.6% of respondents had ever smoked cigarettes; 86% of them continued to smoke. The D.A.R.E. group had a significantly lower rate of smoking compared with their non-D.A.R.E. counterparts (8.7% vs. 28.0%; p = 0.0001). Logistic regression analysis shows that the D.A.R.E. group was five times (odds 4.9; p = 0.003; 95% CI: 1.7,14.0) less likely to initiate smoking compared with the non-D.A.R.E. group. The D.A.R.E. group had a significantly (p = 0.002) higher knowledge score on the risk of smoking. The knowledge score has strong opposite correlation to smoking behavior (p = 0.00001). Students with top-quartile knowledge scores had a substantially lower rates of smoking (1.4% vs. 14.4%; p = 0.001). This finding is consistent for both African-American (0% vs.19.6%; p = 0.001) and white children (1.9% vs.13%; p = 0.001). The D.A.R.E. program may have an impact in preventing the initiation of smoking behavior. (*J Natl Med Assoc.* 2002;94:249–256.)

Key words: prevention ♦ adolescent smoking ♦ D.A.R.E. program impact ♦ race ♦ risk knowledge

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Smoking is the single most preventable cause of death. Tobacco use is related to approximately one in five deaths in the United States.[1] Cigarette smoking is responsible for one third of all cancer deaths; it is the main cause of lung cancer and has been associated with cancers of the mouth, pharynx, larynx, esophagus, pancreas, uterus, cervix, kidney, and bladder.[2] More than 87% of lung cancers are related to smoking, and current smokers die from lung cancer at a rate up to 20-fold

higher than the rate for never smokers.[2] Cigarette smoking is also a major cause of chronic obstructive pulmonary disease,[3] heart disease, cerebrovascular disease, chronic bronchitis, and emphysema.[2]

Cigarette smoking is one of the main risk factors for cardiovascular disease.[4,5] There is a strong correlation between cigarette smoking and development and progression of arteriosclerosis.[6] Smoking may cause structural[7] or functional changes[5,8] in the coronary artery. Exposure to smoking deteriorates oxygen delivery,[9] causes coronary vasoconstriction, damages the endothelium[10,11], impairs the arterial endothelial function,[12] and increases the thickness of the arterial wall.[13] The affect of smoking is not limited to smokers. Secondhand smoking has similar detrimental health effects as smoking, but to a lesser magnitude and extent.

Secondhand smoking causes up to 40,000 deaths from heart disease[14] and 3,000 deaths from lung cancer per year. It has also been related to thousands of chest discomfort cases and up to 300,000 cases of pneumonia and bronchitis in children.[15] Secondhand smoking increases the number and severity of asthma attacks in approximately 200,000 to 1 million children.[15] It is a risk factor for sudden infant death syndrome. Considering these diseases, a direct health care cost caused by smoking is estimated to be $50 billion per year.[16] Smoking has tremendous detrimental effect on health and well-being of our nation.

Smoking is believed to be the gateway to the usage of other addictive substances. Studies with adolescents suggest that current smokers are up to 17 times more likely to use addictive substances such as alcohol and marijuana than their counterparts who have never smoked.[17] The Centers for Disease Control and Prevention reports a 73% increase in adolescent smoking since 1988. More than 6000 teens experiment with cigarette smoking, and at least 3000 teens become regular smokers daily.

An alarmingly high number of children become addicted to tobacco use every day, making adolescent smoking a major public health problem.[18–22] Prevention of smoking behavior among adolescents is now a public health priority in the nation. The logic behind the prevention efforts in children is based on the research conclusion that if the onset of smoking behavior can be prevented during childhood, smoking is less likely to occur during the rest of life. [22–25] The initiation of smoking behavior is influenced by multiple factors, including peer pressure,[26–32] stress,[33–35] curiosity, and lack of knowledge about the detrimental effect of smoking.[36–38]

To teach children the skills to resist the influences surrounding the initiation of tobacco and other drug use, a Drug Abuse Resistance Education (D.A.R.E.) program was developed.[39,40] The D.A.R.E. program is now being implemented in more than three fourth of the schools in the United States.[39] The D.A.R.E. lessons focus on providing information on alcohol and drugs to include tobacco, decision-making skills, ways to resist peer pressure, and ideas for alternatives to drug use. Our target school used the D.A.R.E. curriculum for fifth-grade students who were taught in the fall semester of the 1998–1999 academic year.

The objective of this study was to test the association between the participation in the D.A.R.E. program and the initiation of smoking in children. This article examined and presents the impact of the D.A.R.E. program in preventing smoking behavior on the fifth- and sixth-grade students.

DESCRIPTION OF THE D.A.R.E. PROGRAM

The D.A.R.E. program was evolved as a joint venture between the Los Angeles Unified School District and the Los Angeles Police Department in September 1983. The program was developed with a mission to provide children with the knowledge and skills to resist peer pressure to experiment with drugs and alcohol.[39] The D.A.R.E. program consists of 17 lessons of approximately 50 minutes each during the school academic semester. The topics included in the curriculum are: (1) practices of personal safety; (2) drug use and misuse; (3)

consequences; (4) resisting pressures to use drugs; (5) resistance techniques—ways to say no; (6) building self-esteem; (7) assertiveness—a response style; (8) managing stress without taking drugs; (9) media influences on drug use; (10) decision making and risk taking; (11) alternatives to drug abuse; (12) other activities; (13) teaching police officer-planned lessons; (14) role modeling; (15) Project D.A.R.E. summary; (16) taking a stand; and (17) assembly and graduation. A workbook was provided to the fifth-grade students in the beginning of the semester. A police officer conducted the course by using a wide range of teaching strategies such as lectures, question and answer, group discussions, role playing, audiovisual material, and workbook exercises. Students learn the harmful effects of drugs when they are misused. This theme is featured and depicted in a commercially distributed film, *Drugs and Your Amazing Mind,* which was shown and discussed in the D.A.R.E. classes.

MATERIALS AND METHODS

Data Collection

A survey was conducted on all fifth- and sixth-grade students of a zoned middle- and upper-middle-class neighborhood school in Nashville, Tennessee. Data were collected using a 25-item questionnaire. This questionnaire was developed based on focus group discussions with study subjects and standardized questions taken from the Centers for Disease Control and Prevention Youth Risk Behavior Survey,[41] which was previously validated and used by the first author on fifth- and sixth-grade students. Four focus group discussions were conducted, two in each grade, to understand issues related to initiation of smoking. Findings from the discussions were incorporated into the questionnaire and was finalized after pretesting 18 students. The variables used in the questionnaire included age, gender, race, grade, live with single or both parents, ever smoked cigarette, current smoking status, age started smoking, who assisted in initiating smoking, reasons for smoking, any smoker in the household, knowledge of health risk of smoking, completion of D.A.R.E. program, and participant's experience about the effectiveness of the D.A.R.E. program in preventing smoking behavior.

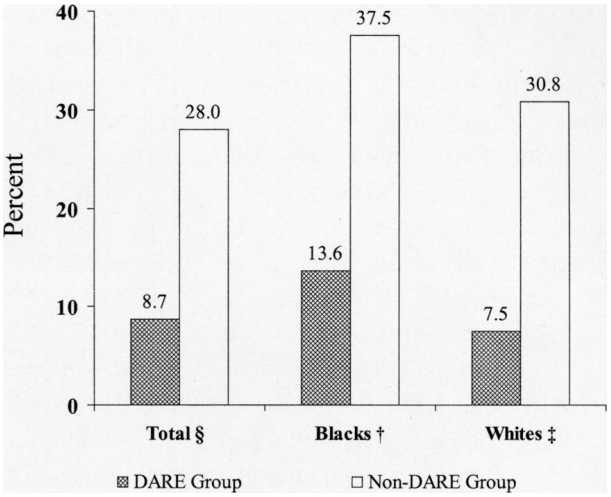
The questionnaire was blinded to protect the confidentiality of the subjects by not including any personal identifiable information on the respondent, such as name, social security number, parents' names, or home address. However, the zip code was collected to confirm the location of school zone. The questionnaires were distributed to the fifth- and sixth-grade classes through their homeroom teachers. The students were asked to complete the anonymous and confidential questionnaire and then to fold and place it in a designated box. The students were given the options to answer all, some, or none of the questions according to their wishes. The data were gathered in May 1999.

Data Analysis

The data were entered into the SPSS database and checked for errors. The respondents were divided into two groups to examine the impact of the D.A.R.E. program. The intervention group is referred to as the D.A.R.E. group in this publication, and members are the respondents who completed and graduated from the D.A.R.E. program. The respondents who did not participate or complete the D.A.R.E. program are in the control group and are referred to as the non-D.A.R.E. group herein. One of the main outcome variables was "ever smoked cigarettes." Another outcome variable is a composite knowledge score, which was created from participant responses on the risk of smoking for lung cancer, heart disease, stroke, oral cancer, and gum disease. The respondent received one point for each correct answer. A knowledge score was the sum of the answers to the five disease categories. Then a dichotomous variable, top-quartile knowledge score, was created based on the response of the students. Those students who scored more than

75% of the correct answers were assigned a value of 1; all other students were assigned a value of 0.

χ^2 tests were conducted to assess the significant differences between the two groups. Fisher's exact test with Yates correction[42] was applied where appropriate. A correlation program was performed on the variables of interest to calculate correlation coefficients after controlling for gender, race, grade, and living with one or two parents. Multiple logistic regression models were performed, and odds ratios with 95% confidence intervals (CI) were calculated for the variables of interest to contrast the D.A.R.E. and non-D.A.R.E. comparison group. A conventional p value less than or equal to 0.05 in a two-tailed method was considered a statistically significant result.



† $p = 0.01$; ‡ $p = 0.001$; § $p = 0.0001$

Figure 1. Percentage of students that ever smoked and their group membership.

RESULTS

Demographic Characteristics

A total of 236 (98%) of the 240 students responded to the survey, and four students refused to answer some or all questions in the survey. Over one half (55%) of the respondents were sixth graders, and 45% were fifth graders. Both genders were represented equally. Sixty-nine (69%) of the respondents identified themselves as white, 24% as African American, and 7% as other races. Approximately 64% of the respondents lived with the both parents, 34% with a single parent, and 2% with other relatives. Thirty percent of students reported that they lived in a home with at least one smoker.

Smoking Behavior

Overall, 10.6% of the students reported affirmatively to the question that asked whether they had ever smoked cigarettes, and 86% of this group reported that they continued to smoke. Those who had reported that they have smoked tried their first cigarette at an age ranging from 6 to 11 years, with a mean age of 8.5 years. The race distribution of those who had ever smoked cigarettes was 16.4% African American, 9.3% white, and 5.9% other races.

D.A.R.E. Program Participation

Approximately 88% of the students had graduated from the D.A.R.E. program. A significantly ($p < 0.04$) higher percentage of girls (94%) than boys (86%), with a greater proportion of whites compared with African Americans (92% vs. 85%) graduated from the program. A slightly higher percentage of sixth graders than fifth graders (91% vs. 87%) completed the D.A.R.E. program; however, a significantly higher percentage of fifth graders (81%) believed that the D.A.R.E. program prevents initiation of smoking behavior compared with Sixth graders (62%), with slightly more girls (75%) expressing this opinion than boys (66%).

Impact of the D.A.R.E. Program

Figure 1 reveals that the D.A.R.E. group had a significantly lower rate of smoking behavior compared with their comparison group counterparts (8.7% vs. 28.0%; $p = 0.0001$). The rates of smoking behavior for comparison groups were approximately three times for Af-

rican Americans and over four times for whites compared with the rates for their counterpart D.A.R.E. group. The result of the multiple logistic regression, after controlling for gender, grade, and race shows that the D.A.R.E. group was almost five times less likely to initiate smoking as compared to the non-D.A.R.E. comparison group (odd of 4.9; $p = 0.003$; 95% CI: 1.7, 14.0). The smoking rate (5.9%) for respondents who believed that the D.A.R.E. program prevented the initiation of smoking behavior was substantially lower than the smoking rate (21.7%) for respondents who did not believe in the D.A.R.E. prevention effect. African Americans who did not think that the D.A.R.E. program prevents smoking had a 5.5 times higher (40% vs. 7.3%; $p = 0.001$) smoking rate than those who believed that the D.A.R.E. program works to prevent smoking. Among whites, a similar direction was observed in these rates (16.7% vs. 6.1%; $p = 0.01$).

The D.A.R.E. group had a significantly ($p = 0.002$) higher mean knowledge score regarding the risk of smoking than that of the comparison group. The knowledge score has strong opposite correlation to smoking behavior (rho = -0.28; $p = 0.00001$), after controlling for gender, race, grade, and living with single or both parents. Figure 2 depicts that students who achieved the top quartile of knowledge score on the risk of smoking had a substantially lower rate of smoking behavior compared with students who did not achieve that score (1.4% vs. 14.4%; $p = 0$ 0.001). The finding held true for both African-American (0% vs. 19.6%; $p = 0.001$) and white children (1.9% vs.13%; $p = 0$ 0.001).

The D.A.R.E. program was taught in fifth-grade classes only among our study students. Figure 3 displays that the fifth-grade D.A.R.E. group had a significantly lower rate of initiation of smoking than their comparison counterparts (4.3% vs. 28.6%; $p = 0.001$). Although the D.A.R.E. group is now in the sixth grade, they had a lower smoking rate than their non-D.A.R.E. counterparts; the rate was significantly higher than the rate in the fifth-grade (12.4% vs. 4.3%; $p = 0.03$) D.A.R.E. group.

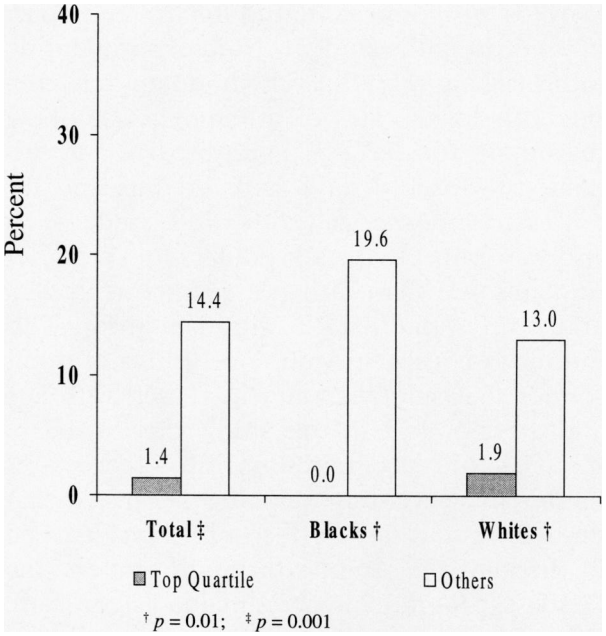


Figure 2. Percentage of students that ever smoked and smoking risk knowledge.

DISCUSSION AND CONCLUSION

Smoking in fifth- and sixth-grade students is primarily experimental. In our study, the

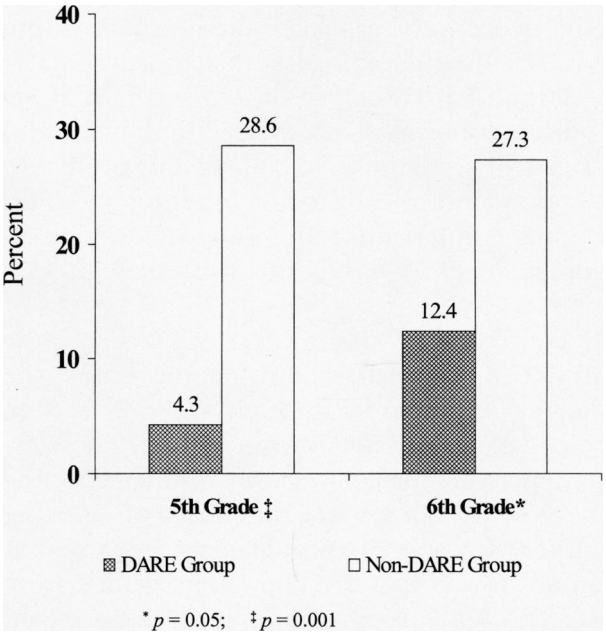


Figure 3. Percent of students ever smoked by their grade and group membership.

D.A.R.E. program was found to have an impact in preventing the students from experimenting with smoking. The D.A.R.E. graduates had considerably lower rates of initiation of smoking than their non-D.A.R.E. counterparts, and this held true for fifth and sixth graders and for both African-American and white students. It also was found that sixth graders had a higher smoking rate than fifth-grade students in general, even in the D.A.R.E. graduate group. This finding is consistent with conclusions of other studies that smoking rates increased with age and grade.[26,43–45] In this study, the impact of the D.A.R.E. program on fifth graders was higher in preventing smoking because it has immediate and novel effects of lessons learned in the class.[46,47] Among the sixth graders, the D.A.R.E. program impact remained significant, although the impact on them decreased compared with the impact on fifth graders. The overall impact of the D.A.R.E. program to prevent smoking remained substantially higher even after adjusting for grade (age), gender, and race effects.

The mechanism of the impact of the D.A.R.E. program may be explained by the fact that the D.A.R.E. group had a higher knowledge score with respect to the detrimental impact of smoking on health; this association also was found in other studies.[40,46,47] This study indicates that the knowledge of the harmful effects of smoking may be a strong protective force against the initiation of smoking. This finding is consistent with some studies done on adolescents[36–38] but is inconsistent with others.[26,48]

The D.A.R.E. program provided the graduates with knowledge and demonstrated the danger of smoking through showing a film, role playing, and behavior modeling. These experiences in turn may have produced an impact on preventing the initiation of smoking among the participants. This study, as well as others, found that the knowledge gained from the D.A.R.E. program may have a significant impact in preventing children from experiment with smoking.[40,46,47] Those who learned about the consequences of smoking and believed that the D.A.R.E. program prevented them from trying tobacco products had a very low rate of initiation of smoking.

Many studies evaluated the D.A.R.E. program effects.[47,49–55] However, very few studies included the prevention of cigarette smoking/tobacco use as the primary outcome of the D.A.R.E. program.[46,47] Studies suggested that there is a short-term effect of the D.A.R.E. program[46,47,49,50,56–60] and that this effect is sustained for 1 to 2 years.[46,47] Although the reason for the decay of the effect over time is unclear, it has been suggested that the impact of the D.A.R.E. program is constantly challenged by new tobacco advertisements, modeling parental smoking habit, and social interactions with new peer groups.[40] We believe that the impacts of the D.A.R.E. program may be sustained much longer if this curriculum can be reinforced at several grade levels and include parental involvement in the program.

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